Photonic crystal waveguide bends for slow light

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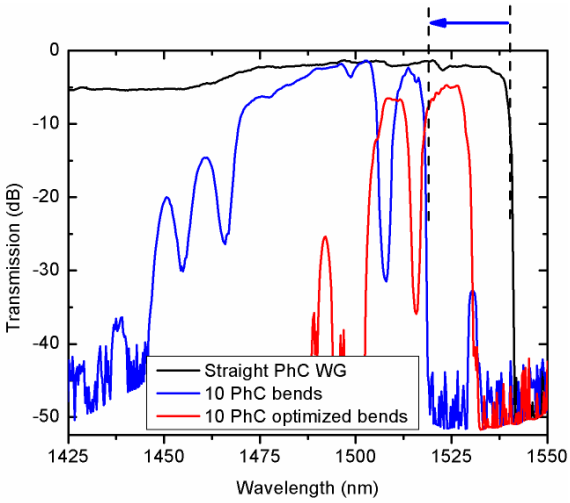

Transmission losses in photonic crystal (PhC) waveguide bends are measured on SOI structures with cascaded 10 and 20 bends for various bend designs. The losses per bend observed for a simple 60° bend are extremely small, not exceeding the experimental accuracy of only ±0.1dB/turn. Surprisingly we have also found that the spectra of the bends exhibit a strong blueshift of the short-wavelength cut-off, which prevents efficient transmission of the slow light mode in the PhC waveguide. This shift can be explained in analogy with conventional strip waveguide bends, where the effective index of the mode decreases as the mode is pushed toward the outer edge of the bend. The usual method to compensate this mode shift is to offset the bend section with respect to the straight section or to increase the refractive index at the bend. Recent theoretical calculations [1] confirmed this hypothesis and suggested the novel design of the PhC bend, where the average refractive index in the outer rows is effectively increased by decreasing the hole radius. These optimized bends were incorporated into the same experimental SOI structure, where the radius of 4 holes adjacent to the bend section is decreased by 50%. As expected, the blueshift characteristic for the simple 60° bends is strongly reduced and transmission in the slow light regime is improved.

[1] N.Moll, G.L.Bona, *Appl. Phys. Lett.*, **85**, 4322 (2004).